JSA NUMBER: JSA-009a **Revision No:** 1 **ORIGINAL:** 9/27/05 **REVISION:** 6/02/07	**Company Performing the Job:** Brown and Caldwell / Subcontractors	**PROJECT MANAGER:** Chuck Zimmerman **SAFETY OFFICER:** Penny Bassett
JOB TITLE OR TASK: Drilling, Subsurface Sampling and Monitor Well Construction – Sonic Drilling	**TITLE OF PERSON(S) WHO PERFORMS JOB:** Site Manager: TBD Site Technicians: TBD	**ANALYSIS BY:** Brian Bass, Chris Gardener **REVIEWED BY:** Penny Bassett

REQUIRED PERSONAL PROTECTIVE EQUIPMENT (PPE) AND/OR PERTINENT JOB SAFETY FORMS:

Minimum PPE: Hard hat, safety glasses, steel-toed boots, long-sleeved shirt, high visibility vest.
Additional PPE (as needed): Leather gloves, nitrile gloves, face shield, ear muffs/plugs, respirator.
Monitoring Equipment:
Job Safety Form: BP Authorization to Work, BP Ground Disturbance Procedure, BP Drilling Procedure, Tailgate Meeting Record

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS	PREVENTIVE OR CORRECTIVE ACTION
1. Pre-Construction Safety Meeting.		1. All employees assigned to this task will attend a pre-construction safety meeting, which will include the pertinent JSAs, Standard Operating Procedures, types of potential hazards, and actual hazards present and controls for those hazards.
2. Drill location setup of drill rig	1. Visitor mishaps and resulting bodily injury. 2. Drilling into underground utilities 3. Striking overhead lines or objects with drill mast.	1. Pay attention to visitors approaching work area. If necessary, setup barriers to keep vehicles and visitors out of the work area and use caution tape if available. 2. Underground utilities should be marked out before drilling begins. Several days before drilling is to begin, call Underground Service Alert (USA) or meet with mine site staff and mark out all of their underground lines in the area. 3. Observe overhead lines, tree limbs, or other objects before raising the mast of the drill rig. Anticipate the radius of sweep going up and coming down, and plan appropriately. Position the drill rig no closer than 20 feet from overhead power lines.
3. Drilling. a. General activities	1. Injury to hearing from noise. 2. Inhalation hazards from dust from drilling activities. 3. Exposure to radiation hazards - low-level (alpha) and/or high-level (gamma) radiation hazards.	1. Wear approved safety ear plugs when working close enough to drill rig that you have to speak louder than your normal voice to someone standing next to you. 2. When necessary, wear appropriate PPE to protect from dust for inhalation hazard. This is usually a half-face air-purifying respirator with dust cartridges. 3. Monitor each drill location for radiation before setting up. Areas with alpha radiation >200 CPM or gamma >200 uR/hr require use of respirator, >500 CPM or gamma >500 uR/hr requires respirator, goggles, tyvek suit and rubber boots.
b. Drilling and advancing the core barrel	4. Physical injury from moving parts of machinery, including change out of drill pipe and core barrel. 5. Physical injury from cables under tension that suddenly	4. Avoid moving parts of machinery. Keep fingers, hands, and arms away from rotating drill head near the top (connection to drive) or near the bottom (hole entrance). Wear leather gloves when handling objects, and steel-toed boots and hard hat at all times. Keep hands away from hydraulic clamps when activated. Keep fingers away from pinch points when screwing pipe joints together. Keep all drill bits secured when not in use, to prevent rolling off the rig or other movement. 5. Do not come near cables under tension, such as those lifting drill

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	release.	pipe, as they tend to twist rapidly until the tension is equalized. Inspect cable and hooks frequently for signs of damage and wear. Do not stand directly underneath a load suspended by cable.
	6. Physical injury from storing drill pipe in pipe rack.	6. Stand clear as drill pipe is lowered into rack by cable; pipes come down fast and could make contact with a person's head, body or hand. Wear gloves and hard hat.
	7. Physical hazards to personnel on the ground in the vicinity of the heavy machinery.	7. Personnel on the ground should keep away from the drill rig unless they are required for the task. Drillers and helpers should work together to lift and carry heavy augers, drill pipe, core barrels or caseing. Do not approach heavy equipment without first establishing eye contact with the operator. Use standard hand signals when noise levels inhibit auditory communication. Ensure that all heavy machinery have audible back-up signals. NEVER work alone when operating heavy machinery.
c. Advancing casing	8. Physical injury when lifting and connecting casing lengths together (potential hand or back injuries).	8. A crane is used to lift longer (10 ft) lengths of casing preventing manual handling, but a potential pinch point occurs when putting lifting strap around casing length. Work with a partner who can lift the pipe just high enough to allow the strap to be placed. Use proper lifting techniques to avoid back strain. Wear gloves when screwing casing lengths together.
d. Remove cores from core barrel	9. Slippery working surface when water added to wash casing down.	9. The possibility of leaking water can cause the working surface to become slippery. Be aware of hazard, wear work boots with skid resistant soles. Avoid getting water splashed in face by wearing safety glasses or face shield.
	10. Hanging core barrel can swing and potentially knock someone on ground or pinch fingers of someone on deck.	10. When core barrel is not in use, it should be secured to prevent movement.
	11. Using hammer to strike core barrel to loosen inner core can result in deflection of hammer and hand or arm injury.	11. When loosening material inside the core barrel, position your body and others around you to avoid being struck by potential deflection of hammer. Use hammer of sufficient mass to preclude the necessity to strike hard, yet allow ease of lifting and handling.
4. Re-fueling of drill rig or heavy machinery.	1. Physical hazards associated with handling and transferring fuel to machinery. These include ignition/explosion, dermal irritation, inhalation of fumes, accidental ingestion, and eye contact.	1. Wear safety glasses or goggles, fuel-resistant gloves, and (if fumes are smelled) a respirator with appropriate organic vapor cartridges. 2. No ignition sources present (e.g., cigarette smoking) 3. Avoid contact of hands with any portion of the face.
5. Maintenance of drill rig or heavy machinery.	1. Physical hazards associated with use of hand tools to tighten or loosen machinery parts.	1. Maintain hand tools in proper working condition. Use the correct tool for the task. Avoid "knuckle-banging" (i.e., pay attention to direction of torqued tool slips) and wear leather gloves when possible.
	2. Physical hazards associated with manual lifting and carrying of machinery parts. 3. Physical hazards associated with moving or falling parts.	2. Lift heavy objects using the legs and not the back. Use wheeled transport equipment for heavy loads. 3. Keep hands away from potential pinch points during handling. Wear steel toe boots. 4. Wear protective eye goggles or face shield.

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	4. Eye injury from ejection of hydraulic fluid from machinery lines. 5. Burns from hot machinery parts.	5. If unsure, test machinery parts with small amount of water. If parts are hot, allow or cause them to cool before working around them.
6. Prepare sample bottles and dress in appropriate PPE.	1. Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.	1. Wear protective gloves and safety glasses or goggles when transferring acid from storage container to sample containers. Ensure that gloves are appropriate for acids.
7. Sample Collection: Soil or Groundwater.	1. Inhalation of dirt or dust during work activities. 2. Inhalation or dermal contact of dirt or dust after work activities. 3. Dermal contact with hot soil cores from the sonic rig. 4. Soil core transfer from sonic core barrel – splashing water.	1. To avoid inhalation of dust, wear a fit-tested half-face respirator with appropriate cartridges for particles and other potential contaminants, including radionuclides. The respirator must be worn whenever field instruments indicate the need, or whenever wind-blown dust is obvious, in combination with detected contaminants. 2. Wear rubber or latex gloves to prevent contact with hands and arms. To avoid inhalation or dermal contact from dirt and dust that can accumulate on clothing, wear coveralls or suits (e.g., tyvek suits) that protect regular work clothes, boots, and hair from exposure to dust and dirt. Remove work clothes, including boots, before entering environments outside of the work site such as your home. 3. Use leather gloves when handling hot soil cores from the sonic rig. If collection of a soil sample from the core is required, allow the core to cool before handling, or wear decontaminated insulated rubber gloves. 4. See #3 above. If water is present in the core barrel above the soil, the person collecting the soil into a plastic sleeve should remove the soil sleeve before all soil is collected, stand back, and allow remaiing soil and water to eject from the core barrel. If this procedure does not prevent contact with splashing water, wear a splash shield over your face.
8. Well Construction	1. Inhalation of silica sand, bentonite, or concrete dust. 2. Eye injury or irritation from splashing ground water. 3. Physical hazards associated with use of hand tools to tighten or loosen drills.	1. Wear a half-face air purifying respirator or well fitting disposable dust mask when pouring sand or bentonite, or mixing concrete. 2. Wear goggles or a face shield when working directly over open boring with ground water near the surface. 3. Maintain hand tools in proper working condition. Use the correct tool for the task. Avoid “knuckle-banging” (i.e., pay attention to direction of torqued tool slips). Wear leather gloves when possible.
9. Cleanup and movement of drill rig.	1. Visitor mishaps and resulting bodily injury. 2. Striking overhead lines or objects with drill mast.	1. Pay attention to visitors approaching work area. When necessary, setup traffic cones and/or other traffic barriers to keep vehicles and visitors out of the work area. Use caution tape if available. 2. Observe overhead lines, tree limbs, or other objects before

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		lowering the mast of the drill rig. Anticipate the radius of sweep coming down, and plan appropriately.
10. All Activities	1. Slips, Trips, and Falls	1. All personnel should be constantly watching for trip hazards such as uneven terrain, holes, ditches, stretched wires or ropes, or any other materials or pieces of equipment in their path. 2. Significant below-grade hazards (e.g., holes or trenches) should be marked with flagging, fencing or other appropriate means to make the obstacle easily identifiable. 3. Footwear appropriate for the terrain and work to be performed must be worn. 4. Muddy, snowy, and icy conditions will warrant a more cautious work attitude. Employees should change work speed and style to fit the weather conditions.
11. All Activities	1. Back, hand, or foot injuries during manual handling of materials.	1. Workers should inspect materials for slivers, jagged or sharp edges, and rough or slippery surfaces. 2. Workers should keep fingers away from pinch and shear points, especially when setting down materials. 3. Workers should wipe off greasy, wet, slippery, or dirty objects before attempting to handle them. 4. In most cases, gloves or other protection should be used to prevent hand injuries. 5. Steel-toed bots should be used for protection of the feet. 6. Routes should be surveyed for obstacles prior to moving materials from one location to another. 7. All three main factors in manual lifting (load location, task repetition, and load weight) must be considered when evaluating what is safe or unsafe to lift. 8. All manual handling of heavy or bulky objects should be carefully planned to avoid injuries and damage to equipment.
12. Unsafe conditions.	1. All potential hazards.	1. Where a situation presents a hazardous condition, the exposed employee will be removed from the hazardous area until all necessary precautions have been taken to eliminate the hazard and ensure their safety.